UCRL-JC-124857 Abs

Beam control and diagnostic functions in the NIF transport spatial filter

Fred R. Holdener , Eldon Ables, Erlan S. Bliss, Steve Boege
Robert D. Boyd, Clifford J. Chocol, Donald T. Davis, Robert D. Demaret,
R. E. English, C. W. Laumann, J. L. Miller and Stanley W.Thomas
Lawrence Livermore National Laboratory, Livermore, CA 94550

	telephone	FAX	e-mail
F. R. Holdener	510-422-7003	510-422-0940	holdener1@llnl.gov
E. Ables	510-422-4809	510-422-0940	eldenables@llnl.gov
E. S. Bliss	510-422-5483	510-422-0940	bliss1@llnl.gov
S. Boege	510-423-6931	510-423-3958	boege@llnl.gov
R. D. Boyd	510-422-6224	510-422-0940	boyd5@llnl.gov
C. J. Chocol	510-423-6230	510-422-0940	chocol1@llnl.gov
D. T. Davis	510-422-8801	510-422-0940	davis14@llnl.gov
R. D. Demaret	510-423-6768	510-422-1930	demaret1@llnl.gov
R. E. English	510-422-3602	510-423-9242	edenglish@llnl.gov
C. W. Laumann	510-423-7735	510-423-9242	laumann@llnl.gov
J. L. Miller	510-423-0311	510-423-9242	jlmiller@llnl.gov
S. W.Thomas	510-422-5363	510-422-0940	thomas22@llnl.gov

(poster presentation preferred)

Abstract

Beam control and diagnostic systems are required to align the NIF laser prior to a shot and then to provide diagnostics simultaneously on 192 beam lines at shot time. In order to accomplish this task within reasonable costs the NIF Conceptual Design Report[1] laid out a method using relatively small optics mounted near the pinhole plane of the 60 m transport spatial filter. This turns out to be a very congested area, and implementation of the conceptual design requires an integrated mechanical design for a 4 high by 2 wide bundle of beams.

For each beam, the central region of the transport spatial filter houses a pinhole holder/changer, three beam pickoffs, three reference reticles, two insertable fiber light sources, an incoherent light source, the main beam injection mirror/optics and a beam dump. This is illustrated in Figure 1. The pinhole holder/changer allows up to eight replaceable shot pinholes plus four alignment pinhole reticles. The three pickoffs are for the 1ω (1053 nm) main laser beam diagnostics, the 3ω (351 nm) converted beam incident on the target, and for viewing the pinhole plane for alignment functions. The three reference reticles are centering references for pinholes #1 and #4 and a back-reflection reference for setting the 3ω beam sampling surface in the final optics assembly using 1ω light. The two fibers are a 1ω source that provides a wavefront reference source for the wavefront sensor and a 3ω source used for transferring alignment from pinhole #4 to the target. The incoherent light source illuminates the alignment reticles used for establishing centroids in the CCD cameras for alignment control. The main beam injection mirror/optics assembly is for insertion of the 0.1 to 10 joule beam from the preamplifier module into the main laser chain through pinhole #1. The beam dumps are for passes #2 and #3 to intercept Pockels cell leakage or back reflections from the target.

---

[1] National Ignition Facility Conceptual Design Report, UCRL-PROP-117093, NIF-LLNL-94-113, May 1994,

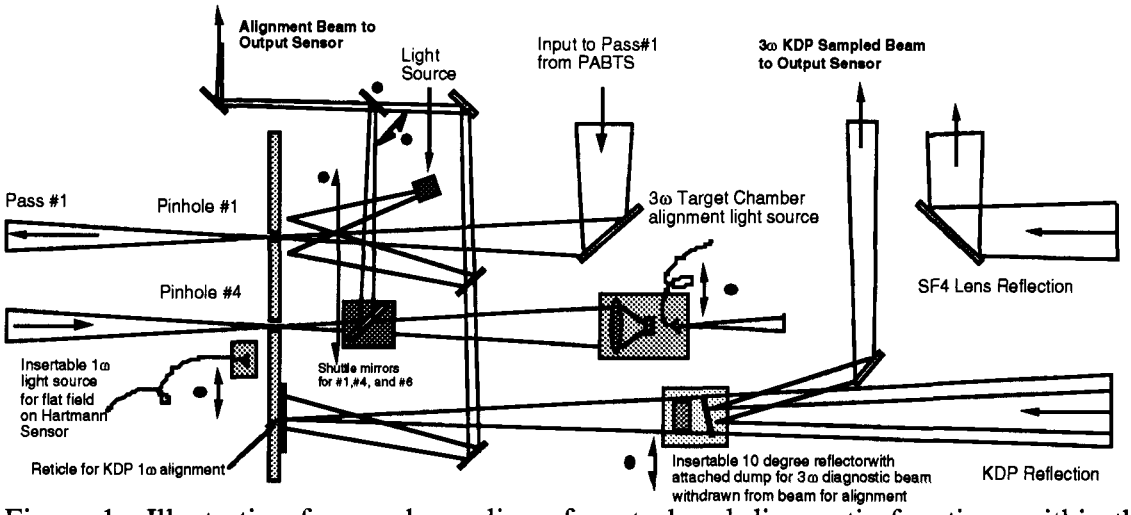

Figure 1. Illustration for one beam line of control and diagnostic functions within the central region of the Transport Spatial Filter.

The above figure is for one beam only whereas in NIF beams are arranged in 4 high by 2 wide "bundles." The present design mounts all components for a bundle on two separate kinematically positioned towers that are considered "Line Replaceable Units" from a maintenance point of view. We will describe this arrangement in more detail and trace the paths of beams to and from the towers for all eight beams. Considerations relating to stability requirements, optical damage thresholds, and pinhole debris will be noted.

This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under contract No. W-7405-Eng-48.